



STRENGTHENING SCIENCE DEPARTMENTS

*How teachers and chairpersons can
help their departments support best practices.*

Todd Campbell, Wayne Melville, and Anthony Bartley

“Although Sam is the science department chair and has been invited to serve on a number of district committees, he is confronted with isolation in his department, where the three science teachers do not work as a team. As a result, he works as a ‘lone ranger’” (Berns and Swanson 2000, p. 4).

Teachers don’t work in a vacuum. They are, in most cases, part of a science department in which teachers and the chairperson have important roles in science education

reform. Current reform is shaped by national standards documents (AAAS 1989; NRC 1996, 2011) that emphasize the pedagogical and conceptual importance of best practices framed by constructivism and focused on teaching science as inquiry. But, while these documents emphasize best practices, research consistently shows that science teachers have difficulties enacting them (Anderson 2002, Keys and Bryan 2001, Windschitl 2004).

Recommendations put forth by most researchers investigating reform emphasize the importance of collabora-



tive professional learning (Loucks-Horsley et al. 1997). As teachers grapple with teaching science differently from how they themselves learned science, they must be challenged in their own thinking and practice and supported in making sense of the reform and seeing how they can incrementally and iteratively change their practice to better reflect the standards.

Melville and Wallace (2007) articulate how science departments can “organize themselves to promote access to professional learning, maintain accountability to their standards of teaching and learning, and encourage teacher leadership” (p. 1204). This article, in turn, describes one science department as an exemplar for how the science teachers and chairperson can support standards-framed best practices. This department, in contrast to the one in the opening excerpt, shows the potential of nurtured work, focused conceptually as not just administrative but also collaborative, as these quotes from a teacher and chairperson exemplify:

Teacher: “I never felt like Will was my chair. I felt he was a more experienced colleague, as opposed to holding a power position. I think a lot of department chairs feel that their role is to keep the department in line. That person may be an administrator but certainly not a curriculum leader. Will was definitely the latter.”

Chairperson: “In my department I hold no power, or at least that’s the perception. I don’t run around telling people what they should and shouldn’t do. It’s just a set of conversations, so I don’t think anyone feels threatened. They see me

as a colleague that has to manage some of the departmental work but also see me as a curriculum leader.”

The chair, then, in collaboration with teachers, influences how well professional learning is supported over the long term.

Developing a vibrant science department

Fogarty and Pete (2009/2010) offer anchors for engaging adult learners for lasting impact. These anchors, providing a framework for understanding how all departments may move closer to the standards, envision learning as sustained, job embedded, collegial, interactive, integrative, and practical.

Sustained and job embedded

Professional learning that helps teachers translate theory into practice takes time and is necessarily embedded, and validated, in the workplace. Within departments, teachers must regularly discuss standards-aligned best practices, such as teaching science as inquiry. These discussions can be enhanced through interactions with subject associations and other science educators. In our exemplar department, these discussions were initiated by both the chair and teachers, who framed them as “a set of conversations” around teaching and learning. The chair said: “It’s the conversations amongst teachers that help bridge the [theory and practice] gap.” These conversations, embedded in the job,

have become commonplace, not as more work but as a different form of work.

Departmental meetings, for example, now focus predominantly on teaching and learning, rather than administrative issues. The department has been able to limit the time spent on administration, putting teaching, learning, and instructional leadership front and center. Ways of streamlining administrative tasks have been found, including passing around the incoming mail and schoolwide announcements in an envelope or via e-mail rather than during meetings. This helps maintain curriculum focus.

Another important quality of the "conversations" is that they aren't just verbal: Teachers in the exemplar department have become accustomed to visiting and observing each other's classrooms. As one teacher comments:

"If I didn't clearly get what he was saying, I would come into his class and observe him doing the lesson. Those classroom observations were key; they were one of the best learning tools that I had."

Additionally, structures such as co-planned assessments and service on end-of-term interdisciplinary science department committees (e.g., the chemistry teacher on a committee with a biology and physics teacher) to assess culminating activities have become commonplace. These structures bring opportunities for collaboration and conversation. For example, a recent visit to the exemplar school revealed a meeting between the chair and a new teacher to discuss the teacher's plans for end-of-term assessments. The chair offered examples of assessments previously used for the course. The overarching aim of the session, however, was to engage in an exploratory conversation around new ideas and to develop assessments that aligned with learning goals.

As the chair nurtures collaboration through specific long-term structures (i.e., teachers observing teachers, co-planned assessments, and interdisciplinary committee assessment service), the department reciprocates by adopting critical conversations as a norm of practice.

Collegial, interactive, and integrated

Science teachers

- ♦ should be seen more as producers of knowledge and less as consumers of knowledge;
- ♦ grow more as they become sources and facilitators of change, and

- ♦ expect and respond positively to a wider array of resources and opportunities through which they are able to engage (e.g., collaborative planning, model lessons, peer conversations) (Yager 2005).

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In our research with departments, these same qualities emerge as important features of exemplary science departments. Adamson et al. (2003) found that, unless challenged in their practices, teachers "teach as they were taught," which, in most cases, is quite different from the best practices outlined in standards documents, such as teaching science as inquiry (Tytler 2007). If teachers are to succeed in reforming students' experiences in schools, critical conversations about teaching and learning are needed. These conversations must be planned and emerge as peers interact with one

another in a collegial manner to question and strategize approaches to science teaching.

Examples of such efforts can be found in interactions with our exemplar department as colleagues:

- ♦ collaborated to co-write and publish a book about their work, *An introduction to scientific inquiry in grade nine* (Jones and Kaplanis 2006), which outlined the development and implementation of a departmental philosophy and practice of science as inquiry; co-planned curriculum routinely; and
- ♦ regularly shared their work through both professional association and academic conferences across North America.

While these initial anchors of adult learning (i.e., sustained and job embedded; collegial, interactive, and integrative) are aligned with the learners' "preferences and predilections" (Fogarty and Pete 2009/2010, p. 32), the extent to which learning is practical is the anchor that may matter most.

Practical

"Teachers require extended opportunities to ground the teaching of inquiry in their own experiences and to converse with colleagues in their school and local area." (Melville 2010, p. 69–70).

If best practices such as teaching science as inquiry are to occur in classrooms, they must be practical, involving practices that science teachers can envision, ascribe meaning to, and enact. The National Science Education Standards (NRC 1996) discuss some of the complexities of reformed science instruction in practical terms.

"Teachers of science constantly make decisions, such as when to change the direction of a discussion, how to engage a particular student, when to let a student pursue a particular interest, and how to use an opportunity to model scientific skills and attitudes. Teachers must struggle with the tension between guiding students toward a set of predetermined goals and allowing students to set and meet their own goals." (NRC 1996, p. 33).

Deciding to teach science as inquiry is important but only the beginning of reform. Next comes, for example, devoting time and effort to learning how to cultivate students' ability to frame researchable questions within existing classroom labs. We believe support for such efforts must be built within the department. By ensuring that what is envisioned translates into tractable experiences for students, the science department can become the epicenter of professional learning.

Conclusion

Teachers, chairs, and departments should serve as vehicles for promoting professional growth. Teachers should initiate and participate actively in developing workplace environments that nourish such growth. Our research suggests a number of issues should be addressed in building an exemplary department. First, the department chair and teachers must make a long-term commitment to instructional leadership, and the principal must explicitly support that commitment. Additionally, a high level of trust should be established among teachers, as their teaching practices and assumptions are critiqued and perhaps challenged. Finally, the process must have a clear purpose as it develops (Jones et al. 2009).

Our hope is that this article will inspire teachers to assert their sense of professionalism as they re-conceptualize and assume ownership of their science department. Start small: Invite people to observe in the classroom and offer their critiques of instructional practices. Ask "What can we learn from each other?" Teachers have to be committed to making changes. The role of an instructional leader (teachers and department chairs alike) is to enhance teaching and learning within the department by carving out time and seeking opportunities (through, for example, peer observations and collaborative discussions). In this framework, "the teacher is not seen as the 'target' for change but as a source and facilitator of change" (Yager 2005, pp. 17–18). ■

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